

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Spectrum Horizons)	ET Docket No. 18-21
)	
Battelle Memorial Institute Petition for)	RM-11713
Rulemaking to Adopt Fixed Service Rules in the)	(Terminated)
102-109.5 GHz Band)	
)	
Request for Waiver of ZenFi Networks, Inc. and)	WT Docket No. 15-245
Geneva Communications LLC)	(Terminated)
)	
James Edwin Wedbee Petition for Rulemaking to)	RM-11795
Allow Unlicensed Operation in the 95-1,000 GHz)	
Band)	
)	

COMMENTS OF STARRY, INC.

Starry, Inc. (Starry)¹ submits these comments applauding the Federal Communications Commission’s (FCC or Commission) decision to start to explore the use of frequencies above 95 GHz for new wireless services.² Through this *Notice of Proposed Rulemaking*, we encourage the Commission to pursue two goals: 1) to take the most minimal regulatory steps necessary to facilitate new uses in bands above 95 GHz (while protecting federal uses); and 2) to explore licensing, service, and technical rules that maximize flexibility in the types of technologies and uses in these bands.

The Commission has a long history of adopting flexible technical rules for spectrum bands – particularly high frequency bands – in advance of the full development of new

¹ Starry, Inc., is a Boston- and New York-based technology company that is utilizing millimeter waves to re-imagine last-mile broadband access as an alternative to fixed wireline broadband. Starry is currently deploying its proprietary fixed 5G wireless technology in the Boston, Washington, DC, and Los Angeles areas, with plans to expand to our presence to additional U.S. cities in 2018.

² *Spectrum Horizons; Battelle Memorial Institute Petition for Rulemaking to Adopt Fixed Service Rules in the 102-109.5 GHz Band; Request for Waiver of ZenFi Networks, Inc. and Geneva Communications LLC; James Edwin Wedbee Petition for Rulemaking to Allow Unlicensed Operation in the 95-1,000 GHz Band*, Notice of Proposed Rulemaking, 83 Fed. Reg. 13888 (adopted Feb. 22, 2018) (*Horizons NPRM*).

technologies. By taking these actions, the Commission can help provide some predictability about the future availability of these bands, thereby encouraging investment in the development of new technologies.

As an innovator in millimeter wave (mmW) technologies, we believe there is a significant opportunity to extend ongoing technological development to bands above 95 GHz. To maximize the flexible development of new technologies and use cases, we suggest the Commission consider more flexible licensing rules, including for point-to-multipoint technologies; allow the use of phased array antennas and lower antenna gains; and add an additional six gigahertz of unlicensed spectrum to the proposed 15.2 gigahertz. We also strongly support the Commission's proposal to create the Spectrum Horizons Experimental Radio License.

I. THE LICENSING RULES SHOULD BE FLEXIBLE TO FACILITATE THE DEVELOPMENT OF NEW TECHNOLOGIES

The Commission proposes to license bands above 95 GHz based on the existing Part 101 licensing rules.³ This is a rational starting point given the similarities in these frequency bands and federal and non-federal sharing obligations.⁴ However, it presupposes a similar use case – point-to-point fixed wireless. We encourage the Commission to consider enhancing the Part 101 framework to create more flexible licensing rules that would facilitate a variety of different use cases, including point-to-multipoint fixed wireless.

High frequency spectrum is incredibly useful for a variety of high-capacity fixed uses within relatively small geographic areas. The inability of spectrum at these high frequencies to travel through physical obstacles is both a limitation and an opportunity. While they may be limited for relatively wide-area use cases, they can be much more intensely shared than lower frequency bands, especially given the right licensing scheme.

While early technological development above 95 GHz has focused on point-to-point technologies or industrial uses like spectroscopy, there is no reason for the Commission to impose a licensing scheme that unnecessarily limits use of these bands to point-to-point. Phased array technology is rapidly developing and could be usefully implemented in bands above 95 GHz for fixed wireless broadband, mobile backhaul, fronthaul, or other services.

³ *Horizons NPRM* at ¶ 32.

⁴ *Id.* at ¶¶ 29-30.

A. The Commission Should Permit Point-to-Multipoint Licensing

While Part 101 is a useful starting point, it unnecessarily limits uses to fixed point-to-point. We strongly urge the Commission to, at a minimum, allow point-to-multipoint within this coordination framework. Point-to-multipoint could be accommodated in a variety of ways, including by allowing point-to-multipoint sites to coordinate into a band just like point-to-point, or by dividing the bands to allow point-to-multipoint in a subset of them.

Assuming the Commission does not make enhancements to the Part 101 licensing regime (as suggested below), it could facilitate point-to-multipoint within it by allowing nationwide non-exclusive licensees to register base stations with an azimuth that would cover a wider area than a very narrow beam width in point-to-point licensing. For instance, the Commission could allow users to register a base station location with a 120-degree or 90-degree azimuth over some distance as determined by a modeled power level. Within this operational zone defined by the azimuth and distance, any customer premises transceiver could operate within a narrower operating parameter, including a much narrower authorized beam width. The coordinators could build this into their coordination process just like any other link that they coordinate and register.

If the Commission believes this type of coordination is too difficult to achieve in combination with point-to-point licensing, we suggest that the Commission identify some subset of frequencies – perhaps up to 50 gigahertz – for this type of point-to-multipoint coordination. While it is inefficient to impose a hard frequency separation between point-to-point and point-to-multipoint, in the absence of any other coordination method, a hard division is a functional way to ensure that point-to-multipoint technologies are not foreclosed by function of a licensing rule.

As an innovative developer of fixed point-to-multipoint technologies in mmW frequencies, we believe there is an opportunity to leverage our significant expertise to unlock the bands above 95 GHz to deliver last mile connectivity to consumers and businesses.⁵ Truly cost-effective fixed wireless broadband delivery relies on the ability to deploy point-to-multipoint systems to avoid costly overbuilding at the same site. We strongly encourage the Commission to recognize this use case and create a viable path to point-to-multipoint deployments in these bands.

⁵ See Starry, Inc., *FCC Progress Report II*, Call Sign WI2XEB, at 12 (filed Dec. 8, 2017), <https://apps.fcc.gov/els/GetAtt.html?id=202100&x=>.

B. The Commission Should Consider Enhancements to Part 101 and Other Licensing Techniques

We suggest that the Commission enhance the Part 101 licensing process to allow point-to-multipoint or other uses by increasing the intensity of sharing in the geographic domain and facilitating sharing in the time domain. Specifically, we encourage the Commission to consider 1) licensing purely on a non-interference basis, requiring beaconing or some other sensing technique in some or all the bands; 2) licensing by-rule for some or all the bands, either as a stand-alone licensing regime or in concert with Part 101 licensing; and 3) licensing indoor and outdoor uses separately.

1. Sensing and the Use of Beacons

As an alternative to Part 101 licensing, or in combination with it, the Commission could authorize all or part of the bands on a non-interference basis using sensing techniques like beaconing. This would be an evolution of coordinated sharing by 1) adding a time element, and 2) by further reducing regulatory barriers. Sensing has long been used to effectively coordinate among WiFi access points and devices. By sensing the spectral environment before transmitting, the 802.11 standard dynamically allows more and more uses within the same frequencies in the same geographic areas by also sharing in the time domain.

In licensed bands above 95 GHz, the Commission could require devices to either have sensing built in or be under the control of at least one device that is capable of sensing the spectral environment. Sensing devices would take a measurement on a small timescale and transmit (or permit other devices to transmit) only when there is clear spectrum. This would allow devices to use as much or as little spectrum as is available for any purposes without any prior coordination or regulatory approval (like site registration).

While requiring sensing would be a new technical obligation, we believe it is a minimal burden that is significantly outweighed by the benefits. In addition, the requirement could be generic, allowing the industry to develop the specific implementation of the sensing techniques.

The benefits could be significant – over time new devices and services could enter the bands without significant and potentially time consuming coordination; bandwidth could be variable based upon an industry developed standard instead of Commission rule; and if the spectrum ever becomes congested, sensing could continue to allow new users in the bands by coordinating in frequency, geography, and time.

Furthermore, it could also enhance federal coordination and new entry over time. Existing or protected federal uses could be protected by signaling that the spectrum is occupied using the industry-standard beaconing technique. It would also better allow new entry by federal users over time because of the addition of sharing in the time dimension. Finally, in the event that a federal system currently does or would require some super-primary right, the federal users could transmit this beacon to effectively protect federal uses within defined protection zones. This would be more efficient for both federal and non-federal users, as the process would be entirely technology based and would require little human intervention.

2. License by Rule and the Use of a Spectrum Access System

In addition, we suggest the Commission consider using license-by-rule for some or all of the frequency bands, either as a stand-alone licensing regime or in concert with Part 101. Under a license by rule regime, licensees could register individual sites more flexibly than under a traditional frequency coordination process.⁶ Using robust Spectrum Access System (SAS), licensees could register new sites in near real-time while protecting important federal uses. Instead of static coordination with defined protection distances and thresholds, the SASs could flexibly accommodate a variety of uses cases in the same area at the same time using advanced propagation analysis. In using a SAS, the Commission could license devices by rule, eliminating the unnecessary regulatory step of registering individual sites in the Commission's Universal Licensing System.

Federal coordination could be enhanced using a SAS. If the SASs could sufficiently meet federal government requirements for the necessary level of classification of information, the SASs could store information about the federal uses and protection requirements – obfuscated to the extent necessary and practical. The SASs could then simultaneously coordinate in new commercial and federal sites and protect existing federal sites.

This type of coordination could either be used to enhance Part 101 coordination or in combination with it to facilitate a new secondary licensing approach, similar to General Authorized Access (GAA) in the Citizens Broadband Radio Service (CBRS).⁷ As a secondary use, the SAS could coordinate opportunistic use of spectrum around sites registered under the Part 101 process. With over 100 gigahertz of spectrum and little information about the necessary

⁶ See 47 C.F.R. §§ 96.7, 96.33.

⁷ 47 C.F.R. § 96.35.

bandwidth for future technologies, this type of coordination would allow different types of uses in different bandwidths to expand in the bands over time.

3. Indoor / Outdoor Licensing

The Commission has explored licensing regimes that divide rights between indoor users and outdoor users in CBRS and parts of the mmW bands considered in the *Spectrum Frontiers* proceeding.⁸ The goal has always been the same: recognizing that transmissions may not travel through physical obstacles, it may be more efficient to allow property owners to control the rights to spectrum within their properties. The same principle applies in bands above 95 GHz – because the spectrum does not readily travel through walls, there is a natural physical separation between indoor uses and outdoor uses.

We acknowledge that while the Commission has considered this type of licensing in the past, it has declined to adopt it in its rules. However, the record developed in response to the *Promoting Investment in the 3.5 GHz Band NPRM*⁹ is now beginning to demonstrate a level of interest from industrial and utility users for exactly this type of licensing.¹⁰

II. THE TECHNICAL RULES SHOULD BE FLEXIBLE TO MAXIMIZE THE POTENTIAL FOR NEW TECHNOLOGY DEVELOPMENT

Like the licensing rules, the Commission proposes to base the technical rules on the existing Part 101 rules. Again, given some of the similarities between these bands, this is a useful starting point. However, we encourage the Commission to maximize flexibility to the greatest extent possible by allowing phased array antennas and decreasing or eliminating the minimum antenna gain.

The Part 101 rules are designed to maximize the number of sites that might be registered for the band in an area, and therefore impose strict technical rules designed to force transmissions to be as narrow as possible. At the outset, we point out that with over 100 gigahertz of proposed spectrum above 95 gigahertz, the Commission may not need be concerned about congestion in these bands now, or ever.

⁸ *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Further Notice of Proposed Rulemaking, 29 FCC Rcd 4273, 4291-92, ¶¶ 58-61 (2014); *Use of Spectrum Bands Above 24 GHz, et al.*, Notice of Proposed Rulemaking, 30 FCC Rcd 11878, 11909-11, ¶¶ 99-104 (2015).

⁹ *Promoting Investment in the 3550-3700 MHz Band; Petitions for Rulemaking Regarding the Citizens Broadband Radio Service*, Notice of Proposed Rulemaking and Order Terminating Petitions, 32 FCC Rcd 8071 (2017).

¹⁰ See IIOT Coalition *Ex Parte*, GN Docket No. 17-258 (filed Apr. 18, 2018).

Nonetheless, the Commission can enhance the possible technical development in these bands through more flexible antenna rules. Phased array technologies for commercial wireless use are still nascent, but offer a significant opportunity to deploy multi-element antennas in these bands, including for point-to-multipoint operations. Phased arrays have the benefit of being able to transmit multiple spectral beams from the same base station, which has significant cost benefits for most types of deployment models and uses. However, because phased array technology is still undergoing significant iteration and development, the Commission could inadvertently discourage innovation by imposing unnecessary limitations.

We suggest that the Commission make clear that phased array technologies can be used in these bands, and that it lower or eliminate the minimum required antenna gain. This will allow greater innovation in antenna technology for these bands, and should not unreasonably increase the coordination burden or congestion in these bands.

III. THE 116-122 GHz BAND SHOULD ALSO BE MADE AVAILABLE ON AN UNLICENSED BASIS

We support the Commission's proposal to make 15.2 gigahertz of spectrum available on an unlicensed basis under Part 15 of the Commission's rules, and encourage the Commission to also make the 116-122 GHz band available for unlicensed operations. The Commission has long recognized the benefit of making spectrum available under Part 15 for unlicensed operations, and the significant technological development that can occur as a result of an unlicensed regime. Most recently, the expansion of unlicensed in the full 57-71 GHz band is a new breeding ground for innovation in low cost mmW technologies for relatively short range, high throughput communication.¹¹

As the Commission points out, it can make another six gigahertz of spectrum available on an unlicensed basis. In particular, given the incumbent passive services in the band, unlicensed operations may be the only practical use of this band for new non-federal operations. As the Commission notes, the limited propagation in these bands combined with the low power of Part 15 operations and protection distances could effectively protect the incumbent passive services. We believe that this is a practical way to increase the opportunity for new, innovative unlicensed technologies in these bands.

¹¹ *Use of Spectrum Bands Above 24 GHz, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8062-66 ¶¶ 125-31 (2016).

IV. THE COMMISSION SHOULD ADOPT ITS PROPOSAL FOR A NEW SPECTRUM HORIZONS EXPERIMENTAL LICENSE

We strongly support the Commission's proposal to create a new Spectrum Horizons Experimental license for bands between 95 GHz and 3 THz. The Experimental Radio Service is a great example of a successful regulatory structure that has encouraged the development of new technologies and services, like Starry's.

Establishing a new type of license specifically for bands above 95 GHz can enhance the technological development in these bands, especially with the modifications that the Commission proposed. Specifically, we support the proposals to allow the marketing of devices, permit wide eligibility, and extend the license term with required reporting.

The ability to market a device and use it in a live deployment – with appropriate disclosures – is a very powerful way to encourage new development and innovation. When developing a technology for a specific commercial use case – instead of for purely academic purposes – the ability to demonstrate the market for the device or service is critical to securing financing. This can enhance the ability of smaller, startup companies to take a financial risk to begin developing a technology while showing its market potential to current and future investors.

We support the proposal to allow broad eligibility and to require applicants to provide a narrative statement of the purpose of the license. This is the current process under the Experimental Radio Service, and it serves to provide at least some level of public disclosure of the type of operations taking place in a band. Combined with interim progress reports, this information itself can further spur innovation by, at a minimum, describing the types of technologies or services that might operate in these bands.

Finally, we support the proposal to extend the licensing term to up to five years. The two-year term in the current rules can be too short of a period within which to develop a new technology or a new business model, and demonstrate market viability. We suggest that up to five years, with an opportunity for a renewal, will be sufficient to allow companies to develop new technologies and begin to test them in real world use cases. Further, having a deadline within a reasonable time could be a helpful forcing function for developers to make a decision about the ongoing viability of a technology and the need for a license.

V. CONCLUSION

We support the Commission's decision to begin to explore the use of bands above 95 GHz for new wireless services, including the creation of a new Spectrum Horizons Experimental License. We believe with some modifications to the licensing and technical rules, the Commission can increase flexibility for new technologies and services to develop in these bands.

Respectfully submitted,
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